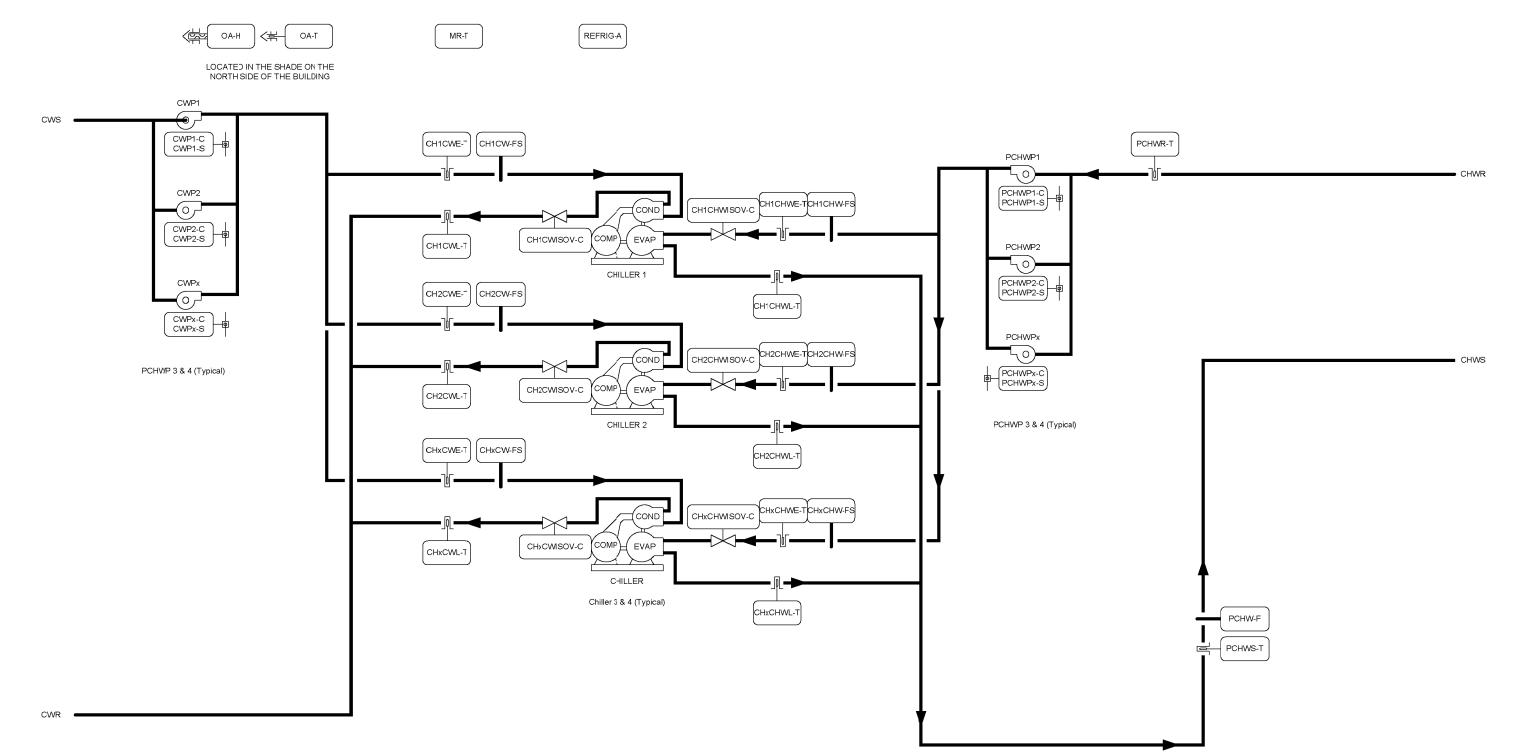
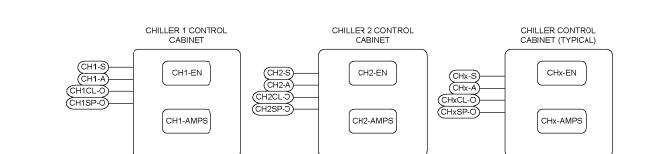


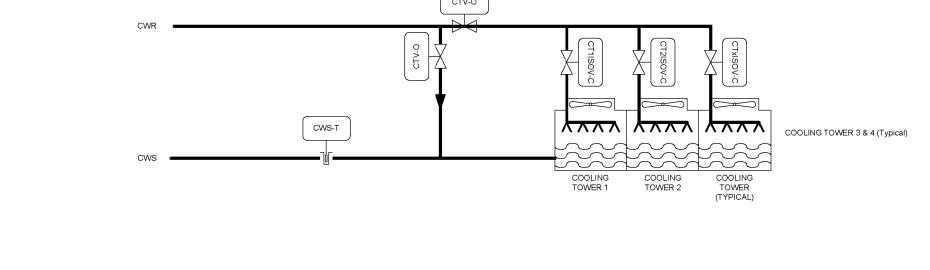
Α п

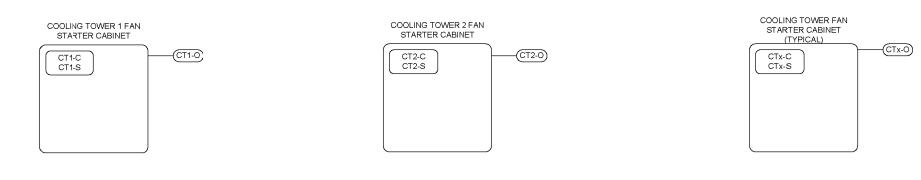
## POINTS LIST

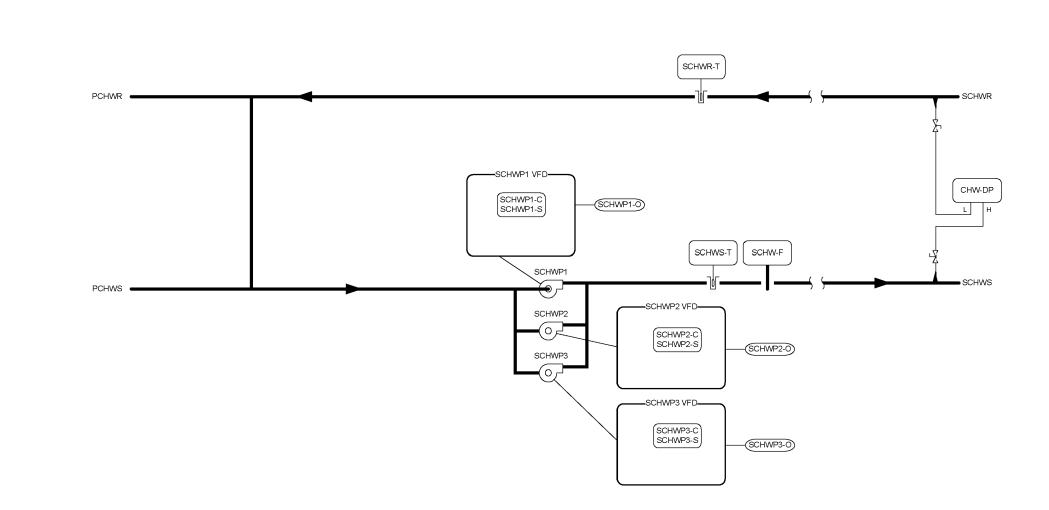
Туре	Name	Description	Туре	Name	Description
BI	CH1-A	Chiller 1 Alarm	ВО	CT1-C	Tower 1 Command
Al	CH1-AMPS	Chiller 1 Amps	ВО	CT1ISOVE-C	Tower 1 Isolation Valve Entering Command
Al	CH1CHWE-T	Chiller 1 CHW Entering Temperature	ВО	CT1ISOVL-C	Tower 1 Isolation Valve Leaving Command
BI	CH1CHW-FS	Chiller 1 CHW Flow Switch	AO	CT1-O	Tower 1 Output
во	CH1CHWISOV-C	Chiller 1 CHW Isolation Valve Command	ВІ	CT1-S	Tower 1 Status
Al	CH1CHWL-T	Chiller 1 CHW Leaving Temperature	ВО	CT2-C	Tower 2 Command
AO	CH1CL-O	Chiller 1 Current Limit Output	ВО	CT2ISOVE-C	Tower 2 Isolation Valve Entering Command
Al	CH1CWE-T	Chiller 1 CW Entering Temperature	ВО	CT2ISOVL-C	Tower 2 Isolation Valve Leaving Command
ВІ	CH1CW-FS	Chiller 1 CW Flow Switch	AO	CT2-O	Tower 2 Output
ВО	CH1CWISOV-C	Chiller 1 CW Isolation Valve Command	ВІ	CT2-S	Tower 2 Status
Al	CH1CWL-T	Chiller 1 CW Leaving Temperature	ВО	СТЗ-С	Tower 3 Command
ВО	CH1-EN	Chiller 1 Enable	ВО	CT3ISOVE-C	Tower 3 Isolation Valve Entering Command
ВІ	CH1-S	Chiller 1 Status	ВО	CT3ISOVL-C	Tower 3 Isolation Valve Leaving Command
AO	CH1SP-O	Chiller 1 Setpoint Output	AO	СТЗ-О	Tower 3 Output
BI	CH2-A	Chiller 2 Alarm	ВІ	CT3-S	Tower 3 Status
Al	CH2-AMPS	Chiller 2 Amps	ВО	CT4-C	Tower 4 Command
Al	CH2CHWE-T	Chiller 2 CHW Entering Temperature	во	CT4ISOVE-C	Tower 4 Isolation Valve Entering Command
ВІ	CH2CHW-FS	Chiller 2 CHW Flow Switch	во	CT4ISOVL-C	Tower 4 Isolation Valve Leaving Command
ВО	CH2CHWISOV-C	Chiller 2 CHW Isolation Valve Command	AO	CT4-O	Tower 4 Output
Al	CH2CHWL-T	Chiller 2 CHW Leaving Temperature	ВІ	CT4-S	Tower 4 Status
AO	CH2CL-O	Chiller 2 Current Limit Output	AO	CTV-O	Tower Valve Output
Al	CH2CWE-T	Chiller 2 CW Entering Temperature	ВО	CWP1-C	Condenser Water Pump 1 Command
ВІ	CH2CW-FS	Chiller 2 CW Flow Switch	ВІ	CWP1-S	Condenser Water Pump 1 Status
ВО	CH2CWISOV-C	Chiller 2 CW Isolation Valve Command	ВО	CWP2-C	Condenser Water Pump 2 Command
Al	CH2CWL-T	Chiller 2 CW Leaving Temperature	ВІ	CWP2-S	Condenser Water Pump 2 Status
ВО	CH2-EN	Chiller 2 Enable	ВО	CWP3-C	Condenser Water Pump 3 Command
BI	CH2-S	Chiller 2 Status	ВІ	CWP3-S	Condenser Water Pump 3 Status
AO	CH2SP-O	Chiller 2 Setpoint Output	ВО	CWP4-C	Condenser Water Pump 4 Command
ВІ	CH3-A	Chiller 3 Alarm	ВІ	CWP4-S	Condenser Water Pump 4 Status
Al	CH3-AMPS	Chiller 3 Amps	Al	CWS-T	Condenser Water Supply Temperature
Al	CH3CHWE-T	Chiller 3 CHW Entering Temperature	Al	ОА-Н	Outdoor Air Humidity
BI	CH3CHW-FS	Chiller 3 CHW Flow Switch	Al	OA-T	Outdoor Air Temperature
ВО	CH3CHWISOV-C	Chiller 3 CHW Isolation Valve Command	Al	PCHW-F	Primary CHW Flow
Al	CH3CHWL-T	Chiller 3 CHW Leaving Temperature	ВО	PCHWP1-C	Primary CHW Pump 1 Command
AO	CH3CL-O	Chiller 3 Current Limit Output	ВІ	PCHWP1-S	Primary CHW Pump 1 Status
Al	CH3CWE-T	Chiller 3 CW Entering Temperature	ВО	PCHWP2-C	Primary CHW Pump 2 Command
ВІ	CH3CW-FS	Chiller 3 CW Flow Switch	ВІ	PCHWP2-S	Primary CHW Pump 2 Status
ВО	CH3CWISOV-C	Chiller 3 CW Isolation Valve Command	ВО	PCHWP3-C	Primary CHW Pump 3 Command
Al	CH3CWL-T	Chiller 3 CW Leaving Temperature	ВІ	PCHWP3-S	Primary CHW Pump 3 Status
ВО	CH3-EN	Chiller 3 Enable	ВО	PCHWP4-C	Primary CHW Pump 4 Command
ВІ	CH3-S	Chiller 3 Status	ВІ	PCHWP4-S	Primary CHW Pump 4 Status
AO	CH3SP-O	Chiller 3 Setpoint Output	Al	PCHWR-T	Primary CHW Return Temperature
ВІ	CH4-A	Chiller 4 Alarm	Al	PCHWS-T	Primary CHW Supply Temperature
Al	CH4-AMPS	Chiller 4 Amps	ВІ	REFRIG-A	Refrigerant Alarm
Al	CH4CHWE-T	Chiller 4 CHW Entering Temperature	Al	SCHW-F	Secondary CHW Flow
ВІ	CH4CHW-FS	Chiller 4 CHW Flow Switch	ВО	SCHWP1-C	Secondary CHW Pump 1 Command
ВО	CH4CHWISOV-C	Chiller 4 CHW Isolation Valve Command	AO	SCHWP1-O	Secondary CHW Pump 1 Output
Al	CH4CHWL-T	Chiller 4 CHW Leaving Temperature	ВІ	SCHWP1-S	Secondary CHW Pump 1 Status
AO	CH4CL-O	Chiller 4 Current Limit Output	ВО	SCHWP2-C	Secondary CHW Pump 2 Command
Al	CH4CWE-T	Chiller 4 CW Entering Temperature	AO	SCHWP2-O	Secondary CHW Pump 2 Output
ВІ	CH4CW-FS	Chiller 4 CW Flow Switch	ВІ	SCHWP2-S	Secondary CHW Pump 2 Status
ВО	CH4CWISOV-C	Chiller 4 CW Isolation Valve Command	ВО	SCHWP3-C	Secondary CHW Pump 3 Command
Al	CH4CWL-T	Chiller 4 CW Leaving Temperature	AO	SCHWP3-O	Secondary CHW Pump 3 Output
во	CH4-EN	Chiller 4 Enable	ВІ	SCHWP3-S	Secondary CHW Pump 3 Status
ВІ	CH4-S	Chiller 4 Status	AI	SCHWR-T	Secondary CHW Return Temperature
AO	CH4SP-O	Chiller 4 Setpoint Output	Al	SCHWS-T	Secondary CHW Supply Temperature
Al	CHW-DP	Chilled Water Differential Pressure			











## SEQUENCE OF OPERATION

TO ADD OR REMOVE CHILLERS.

CHILLED WATER PLANT IS DESIGNED FOR N+1 REDUNDANCY.

FAILURE OF A SINGLE COMPONENT WILL ONLY DISABLE THAT COMPONENT, NOT RELATED COMPONENTS.

CHILLERS (CHP-1, CHP-2, CHP-3, AND CHP-4).

THE PLANT IS CONTROLLED THROUGH THE ENGINEERING CONTROL CENTER (ECC).

CHILLER WITH MOTORIZED BUTTERFLY VALVES TO SHUT OFF CHILLED WATER AND CONDENSER WATER TO CHILLER WHEN NOT IN OPERATION (CH-3 AND

PRIMARY CHILLED WATER PUMPS TO CIRCULATE CHILLED WATER THROUGH

SECONDARY CHILLED WATER PUMPS TO CIRCULATE CHILLED WATER THROUGHOUT CAMPUS (CHWP-1, CHWP-2, AND CHWP-3).

COOLING TOWERS TO REJECT CHILLER HEAT TO THE ENVIRONMENT, WITH MOTORIZED BUTTERFLY VALVES TO SHUT OFF CONDENSER WATER FLOW TO TOWER WHEN NOT IN OPERATION (CT-1 AND CT-2).

CONDENSER WATER PUMPS TO CIRCULATE CONDENSER WATER FROM THE CHILLER TO THE COOLING TOWER (CWP-1, CWP-2, CWP-3, AND CWP-4).

ON SIGNAL FROM THE ECC, THE FIRST SECONDARY CHILLED WATER PUMP (CHWP-X) IS ENABLED. VARIABLE FREQUENCY DRIVE BRINGS PUMP UP TO SPEED THROUGH INTERNAL RAMP-UP RATE (180 SECONDS, ADJUSTABLE). PUMP IS SET TO MAINTAIN A DIFFERENTIAL OF 35 PSI (ADJUSTABLE) BETWEEN SUPPLY AND RETURN HEADERS. IF FIRST PUMP IS UNABLE TO MAINTAIN PRESSURE DIFFERENTIAL, FIRST PUMP SHALL RISE TO 93% CALCULATED PUMP CAPACITY, SECOND PUMP IS STARTED AND RAMPED UP TO SAME SPEED AS OPERATING PUMP. ONCE EQUAL SPEED IS ACHIEVED, BOTH PUMPS SLOW DOWN TOGETHER TO MAINTAIN PRESSURE. WHEN PUMPS SLOW TO 70% SPEED, LEAD PUMP CYCLES OFF AND LAG PUMP BECOMES LEAD PUMP. ON NEXT PUMP CYCLE, SPARE PUMP BECOMES LAG PUMP. ON FAILURE OF A PUMP AS REPORTED BY VFD, PUMP IS LOCKED OUT AND TAKEN OUT OF THE ROTATION. ALARM IS REPORTED BY ECC. FLOW METER ON CHILLED WATER MAIN HEADER PROVIDES DATA TO THE ECC TO DETERMINE THE TOTAL CHILLED WATER BEING SUPPLIED TO THE CAMPUS. PROVIDE TEMPERATURE SENSORS ON MAIN SUPPLY AND MAIN RETURN HEADERS. ECC

CALCULATES THE TONNAGE BEING USED BY THE CAMPUS AND DETERMINES WHEN

ON RISE IN CHILLED WATER SUPPLY HEADER ABOVE 43°F (ADJUSTABLE), ECC COMMANDS MOTORIZED BUTTERFLY VALVES ON FIRST CHILLER (CH-X) CHILLED WATER CIRCUIT AND CONDENSER WATER CIRCUIT TO OPEN. AFTER PROOF OF FLOW IS RECEIVED, ECC COMMANDS ON FIRST PRIMARY CHILLED WATER PUMP (CHP-X) AND FIRST CONDENSER WATER PUMP (CWP-X). FIRST COOLING TOWER (CT-X) ISOLATION BUTTERFLY VALVE IS OPENED. COOLING TOWER BYPASS VALVE OPERATES AS REQUIRED TO PROVIDE CONDENSER WATER RETURN TEMPERATURE OF 75°F (ADJUSTABLE) TO CHILLER. AFTER 30 SECONDS (ADJUSTABLE) CHILLER IS ENABLED. IF CHILLER SÉNSES PROPER CHILLED WATER AND CONDENSER WATER FLOW, CHILLER OPERATES THROUGH ITS INTERNALLY SUPERVISED SEQUENCE TO CONTROL DISCHARGE WATER TEMPERATURE TO 45 F. VFD INTERNAL TO CHILLER ADJUSTS CHILLER SPEED TO ADJUST CHILLER CAPACITY. COOLING TOWER BYPASS VALVE CLOSES WHEN RETURN WATER REACHES 75'F (ADJUSTABLE). COOLING TOWER INTERNAL CONTROLS AND VFD ADJUST FAN SPEED TO MAINTAIN BASIN TEMPERATURE OF 85°F (ADJUSTABLE). IF COOLING TOWER IS OFF AND BASIN TEMPERATURE DROPS BELOW 35°F (ADJUSTABLE), ELECTRIC IMMERSION HEATER IS ENERGIZED.

EMS MONITORS CHILLER OUTPUT AND IF TONNAGE OF CHILLER IS AT 80% FOR 20 MINUTES AND DOES NOT SATISFY CAMPUS LOAD, SECOND CHILLED WATER PRIMARY PUMP (CHP-X) IS STARTED AND AFTER PROOF OF OPERATION BY CURRENT SENSOR, SECOND CHILLER (CH-X) CHILLED WATER ISOLATION BUTTERFLY VALVES ARE OPENED. SECOND CONDENSER WATER PUMP IS STARTED, AND AFTER PROOF OF OPERATION BY CURRENT SENSOR, SECOND CHILLER CONDENSER WATER ISOLATION BUTTERFLY VALVES ARE OPENED. SECOND COOLING TOWER ISOLATION BUTTERFLY VALVE IS ALSO OPENED. AFTER PROOF OF VALVES OPENING, CHILLER IS ENABLED. IF CHILLER SENSES PROPER CHILLED WATER AND CONDENSER WATER FLOW, CHILLER OPERATES THROUGH ITS INTERNALLY SUPERVISED SEQUENCE TO CONTROL DISCHARGE WATER TEMPERATURE TO 45°F. ON FAILURE OF ANY COMPONENT TO OPERATE PROPERLY ON START UP, THAT COMPONENT SHALL BE DISABLED AND NEXT AVAILABLE COMPONENT (PUMP, CHILLER, OR TOWER) IS BROUGHT INTO SERVICE TO ALLOW START SEQUENCE TO PROCEED. FAILED COMPONENTS ARE LOCKED-OUT AND ECC GENERATES ALARM. ON INCREASE IN LOAD BEYOND CHILLER 1 AND CHILLER 2 CAPACITY AT 80%, THIRD CHILLER GROUP IS BROUGHT ON PER SEQUENCE.

ON DROP IN LOAD BELOW 40% OF THE 3 CHILLERS, LEAD CHILLER IS COMMANDED OFF AFTER SHUTDOWN SEQUENCE BY CHILLER IS COMPLETE, ASSOCIATED CHILLED WATER AND CONDENSER WATER MOTORIZED VALVES CLOSE, TOWER MOTORIZED VALVE SHUTS, AND ASSOCIATED CHILLED WATER AND CONDENSER WATER PUMPS SHUT OFF AFTER PROOF OF VALVE CLOSURE. FAILURE OF ANY COMPONENT TO PROPERLY CLOSE OR SHUT OFF ALARMS AT ECC. ON DROP IN LOAD BELOW 30% OF THE 2 CHILLER CAPACITY, LEAD CHILLER IS COMMANDED OFF PER THE SEQUENCE ABOVE.

ROTATE ALL COMPONENTS TO BE BROUGHT ONLINE AS LOADS INCREASE.

REFRIGERANT ALARM SYSTEM MONITORS CHILLER ROOM. ON DETECTION OF REFRIGERANT IN THE ROOM, ECC IS NOTIFIED. ON RISE IN CONCENTRATION ABOVE 25,000 PPM, AUDIBLE AND VISUAL ALARMS AT BUILDING AND AT THE ECC ARE TRIGGERED, EMERGENCY PURGE FAN IS STARTED, AND MOTORIZED OUTDOOR AIR LOUVERS ARE OPENED. CHILLERS ARE COMMANDED OFF THROUGH THE ECC, AND AFTER CHILLERS ARE SHUT DOWN THROUGH THEIR INTERNAL SEQUENCE, ALL CONDENSER AND CHILLED WATER PUMPS SHUT DOWN, AND MOTORIZED VALVES

## NOTES:

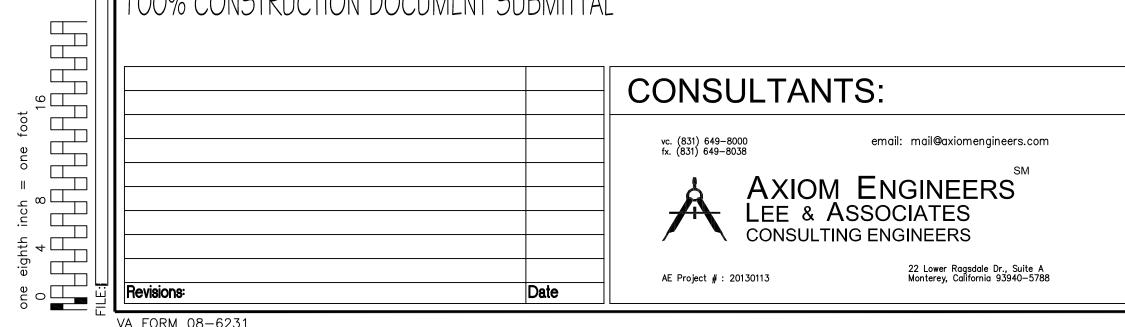
REFRIGERANT ALARM:

1. (E) CH-1 AND (E) CH-2 IN BUILDING 22, ASSOCIATED PRIMARY, SECONDARY, AND CONDENSER WATER PUMPS, AND COOLING TOWER PUMPS ALL REMAIN. THEY PROVIDE PEAK DEMAND AND BACKUP CAPACITY. THE (E) ECC REMAINS IN PLACE AND CONTROLS THE EQUIPMENT. INTEGRATION OF THE (E) CHILLERS, (E) PUMPS, ETC. INTO NEW CENTRAL PLANT SEQUENCE OF OPERATION IS NOT PART OF THIS

2. ALL CHILLED WATER SYSTEM SEQUENCES AND PROGRAMS SHALL BE STORED IN LOCAL NCE, IN CHILLER ROOM.

00% CONSTRUCTION DOCUMENT SUBMITTAL

VA FORM 08-6231





hfp architects 745 distel drive, suite a los altos, ca 94022 650 964 4514 fax: 650 967 5148

ARCHITECT/ENGINEERS:

5



6

awing Title	Project Title			Project Numb
ONTROL SYSTEM	VA CENTRAL CALIFOR	570-13-		
RCHITECTURE	NEW BUILDING 22A + (	Building Num		
				22A
proved: Project Director	Location	Drawing Num		
	FRESNO, CA.	000 000		
	Date	Checked	Drawn	22A-MS
	5/08/2015	WME	CADD	Dwg 63

Office of Construction and Facilities Management Department of Veterans Affairs

Dwg. 63 of 86

9